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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.  | CONFIRMATION NO. |
|-----------------|-------------|----------------------|----------------------|------------------|
| 09/944,487      | 08/30/2001  | Eugene H. Cloud      | 4296.IUS (00-0054.1) | 2698             |

24247 7590 08/08/2003  
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| EXAMINER |
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FARAHANI, DANA

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| ART UNIT | PAPER NUMBER |
|----------|--------------|

2814

DATE MAILED: 08/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                 |              |
|------------------------------|-----------------|--------------|
| <b>Office Action Summary</b> | Application No. | Applicant(s) |
|                              | 09/944,487      | CLOUD ET AL. |
|                              | Examiner        | Art Unit     |
|                              | Dana Farahani   | 2814         |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 30 May 2003.
- 2a) This action is FINAL.                            2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1-7,9-24 and 26-44 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 1-7,9-24 and 26-44 is/are rejected.
- 7) Claim(s) \_\_\_\_\_ is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on \_\_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) The proposed drawing correction filed on \_\_\_\_\_ is: a) approved b) disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) The oath or declaration is objected to by the Examiner.

#### Priority under 35 U.S.C. §§ 119 and 120

- 13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) All b) Some \* c) None of:
    1. Certified copies of the priority documents have been received.
    2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
  - a) The translation of the foreign language provisional application has been received.
- 15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

#### Attachment(s)

|  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                  | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)         | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-7, 9-16, 41, and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hultmark et al., hereinafter Hultmark (U.S. Patent 6,232,667), previously cited, in view of Cobbley et al., hereinafter Cobbley (U.S. Patent 6,064,120), a newly cited reference.

Regarding claims 1, 7, and 42, Hultmark discloses in figures 2A and 2B, a method for interconnecting at least two semiconductor dice, 26 and 30, comprising: providing a first semiconductor die 26, including a plurality of bond pads 31, arranged in an array over an active surface thereof; providing at least one second semiconductor die 30 including a plurality of bond pads 29 on an active surface thereof; and orienting said first semiconductor die and said at least one second semiconductor die with said active surfaces thereof facing each other such that some bond pads of die 26 remain exposed and some bond pads of die 26 are electrically connected with the corresponding pads of die 30.

Hultmark does not disclose recessed bond pads.

Cobbley discloses in figure 5, recessed bond pads 34, which are included in the structure in order to bring the pads to appropriate contacts with electrodes 20 (see

column 2, lines 30-43). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use recessed bond pads in Hultmark structure to facilitate bonding procedure between the bond pads and other bond pads and electrodes which will be connected to the recessed bond pads.

Regarding claims 2 and 3, see Hultmark, column 5, line 21, wherein it is stated that the chips may be memory devices and logic dice

Regarding claims 4-6, in Hultmark, conductive solder bumps 32 are directly between pads of the semiconductor dice 26 and 30.

Regarding claim 9-11, in figure 1 of Hultmark a carrier 20, with recess 21, is provided with contacts 33 on a surface thereof, and the first die is oriented such that pads 33 are connected with the corresponding pads of die 26.

Regarding claims 12 and 41, in Hultmark, the second die is in the recess, and a cover sealing 35 is over the two dies.

Regarding claim 13, in Hultmark, leads 33 correspond to the exposed pads of the first die.

Regarding claims 14-16, in Hultmark, conductive solder bumps elements 32 are between the bond pads of the substrate and the first die.

3. Claims 17, 18, 20-24, 26-34, and 36-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hultmark in view of Cobbley, as applied to claim 1 above, and further in view of Buckley, III et al., hereinafter Buckley (U.S. Patent 5,477,082), previously cited.

Regarding claims 17, 18, 20-22, 33, 34, and 36-38, Hultmark in view of Cobbley renders obvious the limitations in the claims, as discussed above, except for the conductive element having first and second members.

Buckley discloses in figure 4 conductive elements 66 and 72, secured to each other, between chips 58 and 56. Also, shown in the figure, is a third conductive member (secured to the other two), element 76, between the two dice. This arrangement increases heat transfer between the two chips (see column 3, line 52). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use such an arrangement in order to increase the heat transfer between the two chips in Hultmark structure.

Regarding claims 23 and 24, Hultmark discloses the limitations in the claims, as discussed above in regard to claim 1, except for the first and second semiconductor dice are connected to each other via laterally discrete, physically unconnected conductive structures.

Buckley discloses in figure 4, the two dice 56 and 58 are connected to each other via laterally discrete, physically unconnected conductive structures 66 and 72. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use such an arrangement in order to reduce the conductive path between the two dice and increase the heat transfer between the two in Hultmark structure.

Regarding claims 26-28, in figure 1 of Hultmark encapsulant 35 is deposited over at least the first die and between the carrier and the first die, and covers the first die (see column 5, lines 61-63).

Regarding claim 29, in figure 1 of Hultmark, pads 33 are on the surface of the substrate.

Regarding claim 30, in figure 1 of Hultmark, there is a recess 21 in the surface of the substrate.

Regarding claim 31, in figure 1 of Hultmark, the second die is disposed in the recess of the substrate.

Regarding claim 32, in figure 1 of Hultmark, leads 33 of the substrate correspond to the bond pads of the first die, which are exposed to the periphery of die 2.

4. Claims 19 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hultmark in view of Cobbley and Buckley, as applied to claims 34 and 18 above, and further in view of Baba (U.S. Patent 6,317,333), newly cited.

Hultmark in view of Cobbley and Buckley renders obvious the limitations in the claims, as discussed above, except for the members of the conductive elements being secured directly to each other.

Baba discloses in figure 3a conductive elements 5a and 5b, of chips 2 and 1, respectively, are directly connected as shown in figure 3b. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to secure the conductive elements of the Buckley structure directly to each other in order to take advantage of the property of direct heat transfer between the two conductive elements.

5. Claims 39, 40, 43 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hultmark in view Cobbley and further in view of Yu et al., hereinafter Yu (U.S. Patent 6,100,593), previously cited.

Hultmark in view of Cobbley renders obvious the claimed invention, as discussed above in regard to claim 1, except for a multi-chip configuration.

Yu teaches in figure 3, a multi-chip configuration that improves the performance of the device in which the chips are used therein, and improves the yield (see paragraph 2, lines 20-24). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a multi-chip configuration in Hultmark structure, as Yu teaches, since it is well known in the art that using a multi-chip configuration improves the characteristics of the devices that the chips are used in.

### ***Conclusion***

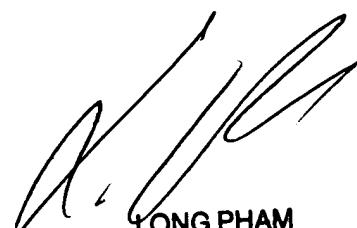
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dana Farahani whose telephone number is (703)305-1914. The examiner can normally be reached on M-F 9:00AM - 6:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M Fahmy can be reached on (703)308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703)872-9318 for regular communications and (703)872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

Dana Farahani

July 30, 2003



LONG PHAM  
PRIMARY EXAMINER